Technical Overview

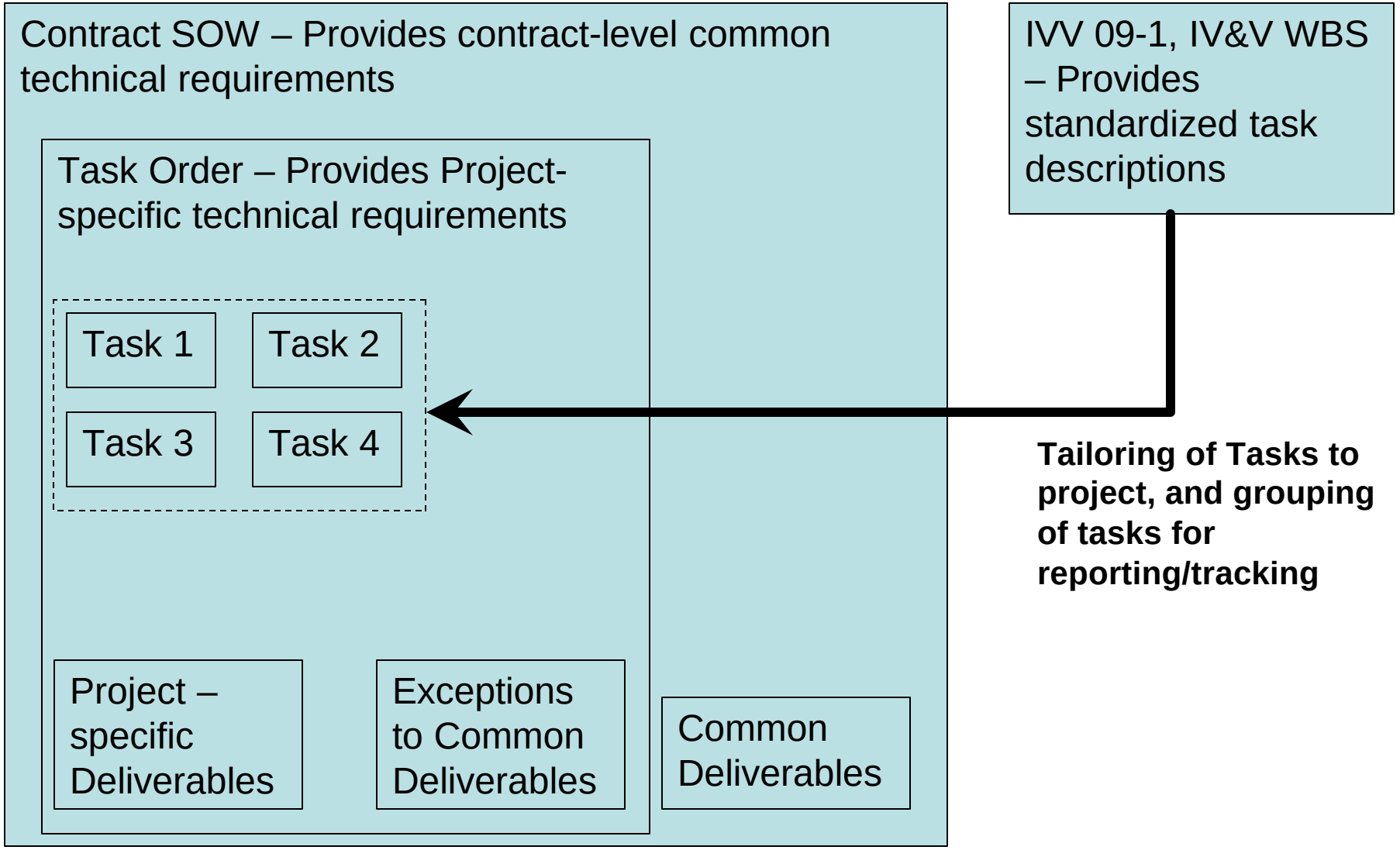
Pre-Solicitation Conference/
Industry Day

NASA IV&V FACILITY
July 28, 2004

Purpose of Presentation

- Provide an overview of the SOW, IVV 09-1, and the RTOs to ensure that the technical requirements are clear and the relationship among the documents is clear

Document Relationship



Statement of Work

SOW Sections 1.1, 1.2, 1.3

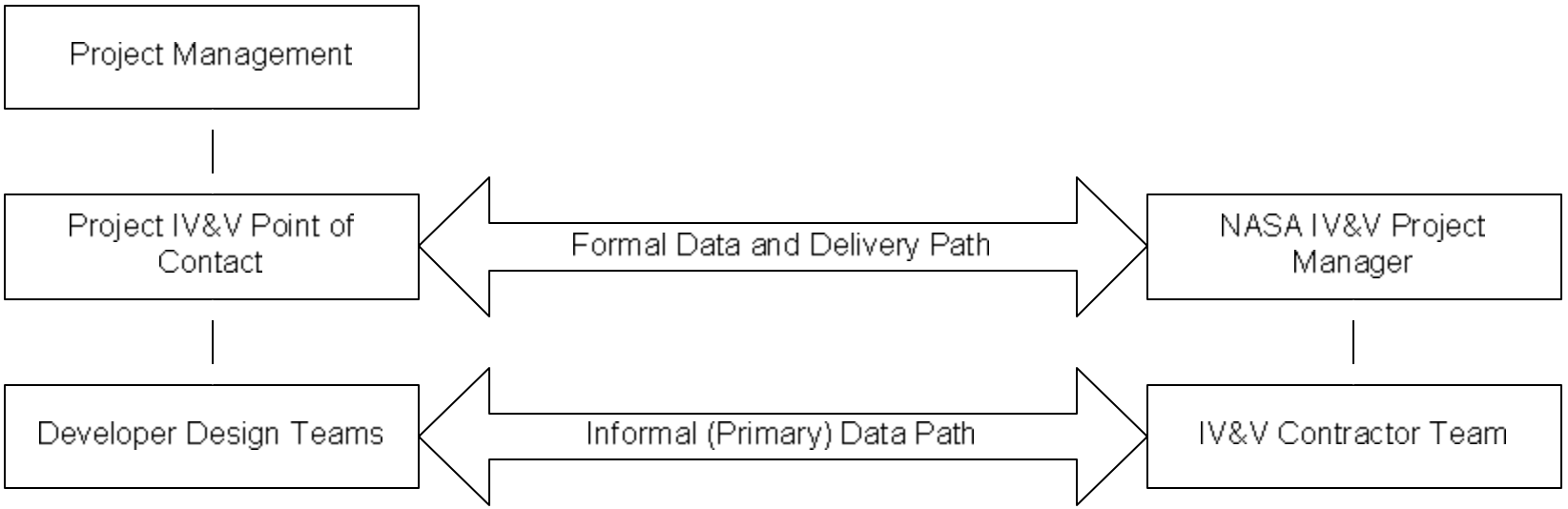
- Section 1.1 Defines IV&V
- Section 1.2 Scope of contract
- Section 1.3 Terminology
  - Do not confuse the term “Task” with “Task Order”. A Task Order will contain a set of requirements that will include the performance of one or more Tasks
  - The term Task was chosen to be consistent with terminology used in IEEE-1012, Software Verification and Validation

SOW Section 1.4

- Provides information on the approach to IV&V services tasking

SOW Section 1.5

- Typical IV&V approach, not requirements
- Mix of team members at developer site and local to IV&V Facility
- “No Surprises” policy



SOW Section 2.0

- Informative documents, not requirements
- Government documents
  - Provide information on how NASA Programs and Projects are managed, how IV&V is managed, the Facility's ISO procedures and strategic implementation plan.
  - NASA Policy concerning IV&V – NASA Facility Civil Servants are responsible for ensuring and applicable requirements are captured in contract SOW or Task Orders
- Industry Documents
  - IEEE/EIA 12207 and IEEE 1012 provide information regarding the framework chosen for the IV&V WBS

SOW Sections 3.1, 3.2, 3.3

- Section 3.1 – Management of the entire effort (Task Order efforts and efforts to fulfill SOW requirements
- Section 3.2 – Continuous Improvement
  - IV&V Facility is putting significant effort into continuous improvement activities
  - Contractor required to have continuous improvement activities in three areas: ISO 9001:2000, CMMI, Metrics
- Section 3.3 – Tools Development and Application
  - Develop special-purpose tools as necessary to perform IV&V on each project
  - Use of Facility standardized tools (currently PITS is only required tool
  - Provide evaluation of new tools to determine if they are suitable for NASA IV&V
    - Tools may have been produced by outside companies, NASA funded research, etc.
    - Performed on an as-requested basis. Rarely requested, and amount of effort required is small

SOW Sections 3.4, 3.5

- Section 3.4 – Because IV&V is part of Mission Assurance, a consolidated record of what was analyzed and how it was analyzed is critical
- Section 3.5 – NASA has a very active Software Assurance research effort. As well, the Facility sponsors additional IV&V related research. The Facility is also increasing its process improvement efforts.

SOW Section 4.0

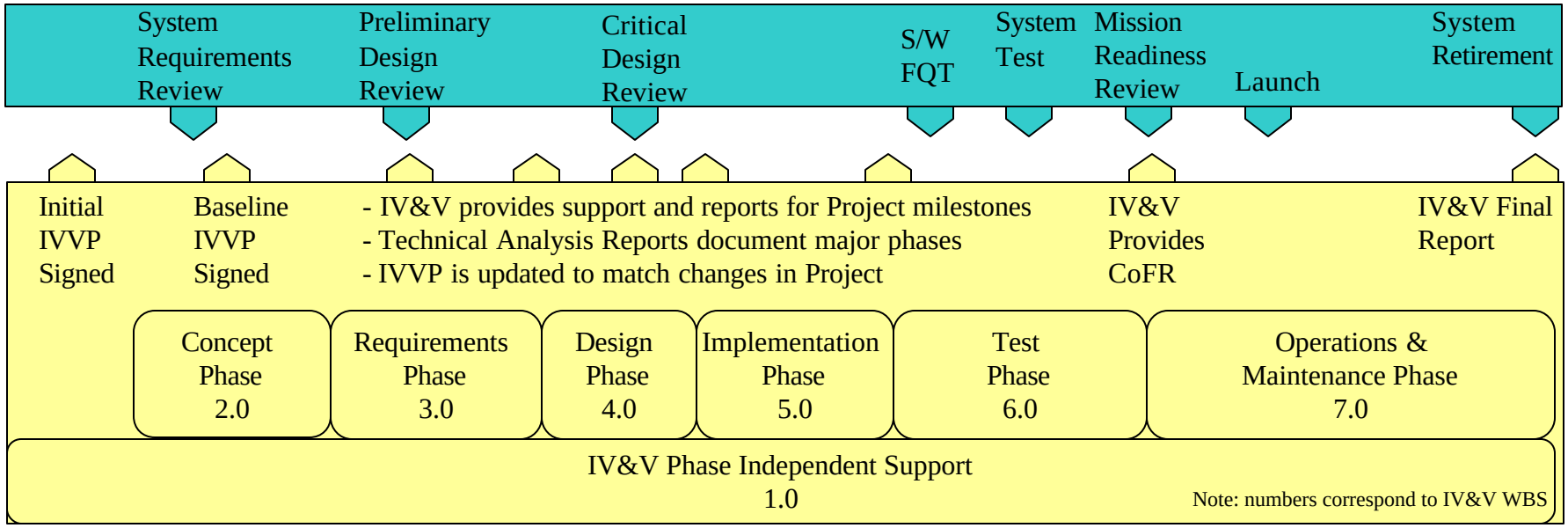
- Most deliverables produced under the contract are Project-specific technical reports that will be defined in each task order
- Contract Progress Report – Provides NASA with status of the IV&V efforts. Primary audience is IV&V Facility personnel.
- Monthly Software Status Reports – Primarily assesses the status of the development project. Also provides some description of what IV&V has accomplished. Primary audience is development project personnel
- Integrated Cost Performance Report – BCWS, BCWP, ACWP. Supplements the Contract Progress Report by quantifying the status of the IV&V work with respect to work plans.

IVV 09-1

IVV 09-1 Overview

- IVV 09-1 provides a set of common task descriptions and completion criteria used for NASA IV&V
- Common tasks help to ensure consistent approaches to similar projects
- Tasks provide framework for tracking and reporting of IV&V progress
- At end of IV&V effort, accomplishments are easier to document and compare to plans
- Task descriptions are based on IEEE 1012 with some modifications
  - Some grouping was done to consolidate tasks that were too small to separately track
  - Modified some tasks to fit Facility priorities
  - Changed test-related tasks to reflect:
    - Test-related task structure more in keeping with NASA experience
    - Independent testing is rarely employed due to cost considerations. Analysis of developer's test plans, procedures, and results much more common. However, REATSS (Reconfigurable Environment for Analysis and Test of Software Systems) development will bring low-cost, dynamic test capability to the Facility in the near future.

IV&V and the Project Life-Cycle



- Life-cycle IV&V is designed to mesh with the Project schedule and provide timely inputs to mitigate risk
- Dialog between the IV&V Facility and the Project must begin before SRR
- For most Projects, IV&V ends (and the Final Report is delivered) on or about MRR. Some Projects have extended S/W development post-launch or major upgrades/maintenance (e.g. Shuttle, MER)

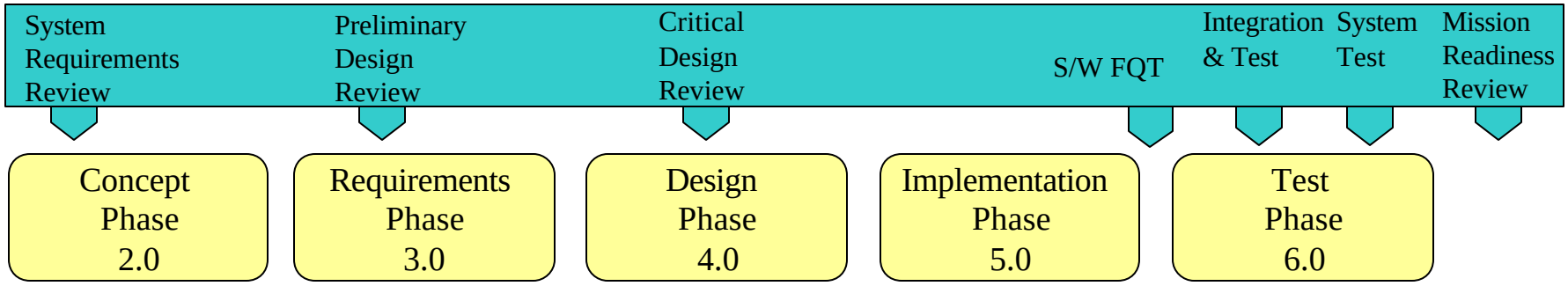
Management and Support Tasks

Project Software Development Life Cycle

Phase Independent Support 1.0

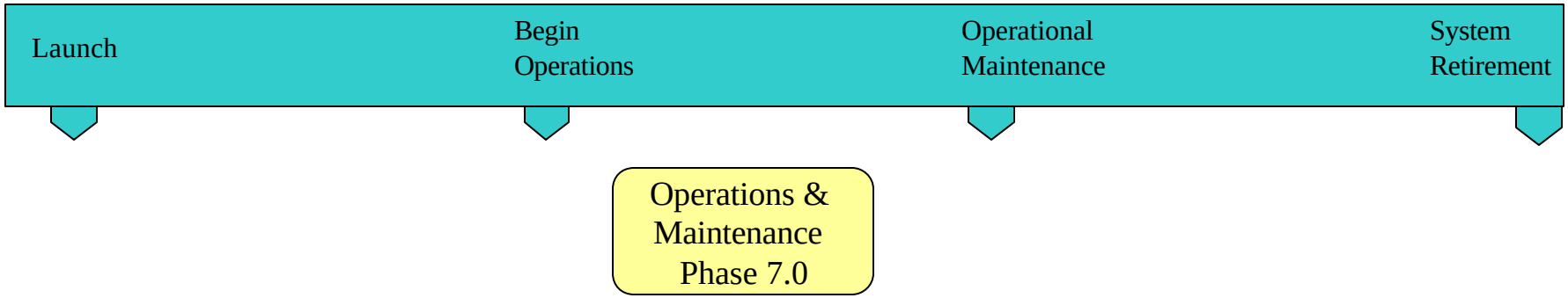
- These tasks help to ensure the proper application of IV&V on projects
- Executed throughout the Software Development Life Cycle
- Covers development of IV&V Plan and interfaces with projects
  - The IV&V Plan (IVVP) documents the IV&V approach for the Project. Some sections of the IVVP require Project concurrence (the sections covering schedule, POCs/Interfaces, reports/deliverables to the Project, and items (e.g. software artifacts) needed by IV&V).
  - Initial IVVP serves to set overall expectations, POCs, etc. It is not a full-blown plan (not enough software detail is usually known).
  - Interfaces include project suppliers (such as contractors building software for NASA). Proper language must be included in development contracts to provide IV&V access to software artifacts.
- Other cross-cutting tasks such as Issue Tracking and Resolution, management review, project review support, etc.

Primary Life Cycle Tasks



- These activities form the core of the effort on any project
- Includes tasks for all life cycles that examine primarily life cycle products
  - Includes such things as requirements traceability analysis, design architecture analysis, code analysis, test analysis, etc.
- Results are documented thoroughly and presented to the project
  - Issues and risks are tracked through closure (task under management and support).
  - Technical reports are provided directly to the projects.
  - Results/issues are communicated immediately. They are not held until formal technical reports.
  - Best interface for resolving technical issues is between IV&V analysts and development personnel.

Close Out and Ongoing Analysis



- IV&V provides a final report documenting its findings and results
  - Supports mission/launch/flight readiness reviews
- Effort not always complete at time of launch
  - Extended missions require after launch support due to software being developed and uploaded during cruise phase
- Some missions have extended life times and perform ongoing software maintenance
  - IVV support mirrors normal life cycle processes but on a smaller level and in an iterative manner
  - Each planned change is a mini-IV&V project (Space Shuttle)

"Optional" Tasks Explanation

- Optional Tasks in IVV 09-1 (Section 8.0) are non-nominal tasks that the facility may require to be done as part of some task orders.
- Why the "optional" title?
  - As part of the IV&V Transition work, a set of baseline tasks were developed for each of four mission classes
  - The remaining, possible tasks were put in the "optional" category
- The baseline tasks for each of the 4 mission classes have not yet been incorporated in IVV 09-1. The mechanics of implementation are still being worked.
- The incorporation of baseline tasks and the inclusion of optional tasks is done by the Government during Task Order development

IV&V Facility

Baseline Tasks Example (may not trace to current IVV 09-1)

- The heading legend is as follows:
  H – Human Rated, R – Robotic, I – Instrument-Only, D – Science and Data Analysis
- Items with an X are the baseline tasks for that type of mission
- Tasks not included in baseline for a particular mission (including 8.0 Optional Tasks) can be performed:
  - As recommended by IV&V to mitigate particular project risks
  - When paid for by Projects to provide additional risk mitigation
  - As funded by the IBD or Code Q

2.0	Concept Phase	H	R	I	D	3.0	Requirements Phase	H	R	I	D
2.1	Reusability Assessment	X	X	X	X	3.1	Traceability Analysis	X	X	X	X
2.2	Distributed Architecture Assessment	X	X	X		3.2	Software Requirements Evaluation	X	X	X	X
2.3	System Requirements Review	X	X			3.3	Interface Analysis	X	X	X	X
2.4	Concept Document Evaluation	X				3.4	System Test Plan Analysis	X	X	X	X
2.5	Software/User Requirements Allocation Analysis	X				3.5	Acceptance Test Plan Analysis	X	X		
2.6	Traceability Analysis	X									

Representative Task Orders

- RTOs were chosen to provide a broad representation of the kind of work anticipated under this contract
  - Mission types (Human and non-human)
  - Deliverables (Different types of technical reports)
  - Tasks (All life cycle phases, some tailoring, plus “optional” tasks)
- RTOs were intended to provide as many “new” projects as possible, but ones that had sufficient actual information to provide a basis for tasking and responses
  - “Fictional” missions were avoided (risk of providing too little information or unrealistic information)
  - No “new” human rated missions have sufficient definition to support an RTO
  - SDO and Kepler have been through the planning and scoping phase but have either recently begun or have not begun IV&V services

RTOs and Bidder's Library

- Purpose of Bidder's library is to provide information necessary for bidders to respond to the RFP (especially background information on the RTOs)
- There were some last minute changes to bidder's library content because of web distribution concerns. Alternatives are being considered.
- More information is being produced and will be posted periodically